ANALYSIS OF LAND SKIN TEMPERATURE USING AVHRR OBSERVATIONS

BY MENGLIN JIN

This newly developed 18-yr AVHRR-based dataset can show the diurnal, seasonal, and interannual variations of land surface skin temperatures.

Satellite-based surface temperature is referred to as skin temperature (Dickinson 1994). The National Research Council (NRC; 2000) and the Intergovernmental Panel on Climate Change (IPCC; Houghton et al. 2001) pointed out the urgent need for long-term remote sensing–based land surface skin temperature (LST) data in global warming studies to improve the limits of conventional 2-m World Meteorological Organization (WMO) surface air temperature observations (T_a). Currently, the long-term surface skin temperature dataset is only available over the ocean [i.e., sea surface temperature (SST), Bates and Diaz 1991]. Over land, developing such a dataset has proved more difficult due to the land's high surface heterogeneities.

AFFILIATIONS: JIN—Department of Meteorology, University of Maryland, College Park, College Park, Maryland
CORRESPONDING AUTHOR: Dr. Menglin Jin, Department of Meteorology, University of Maryland, College Park, College Park, MD 20742
E-mail: mjin@atmos.umd.edu
DOI: 10.1175/BAMS-85-4-587

In final form 21 October 2003

Beside being an indicator of climate change, skin temperature (in particular, its diurnal cycle) is needed in calculating sensible and latent heat fluxes. Specifically, sensible heat flux is determined by the instantaneous difference between LST and near-surface T_a. In the conventional bulk equation, the use of daily averaged LST instead of hourly LST can result in errors up to 100 W m^{-2}.

The National Oceanic and Atmospheric Administration (NOAA) polar-orbiting satellites have unique advantages for the LST dataset development because of a long observation period, global coverage, easy data access, an abundance of excellent research, and operational efforts to promote a retrieval process of the highest quality possible. NOAA's Advanced Very High Resolution Radiometer (AVHRR) uses thermal infrared channels to measure the radiative emission of the surface. LST can be derived from AVHRR radiances after removing atmospheric and surface emissivity effects (Ulivieri et al. 1994; Wan and Dozier 1996; Becker and Li 1995; Prata et al. 1995; Kerr 1997). However, AVHRR radiance is measured only twice per day for most areas. How to interpolate these twice-per-day observations into diurnal cycles has been studied for years and is still an ongoing research topic (Jin and Dickinson 1999, 2000;